NASA SBIR/STTR Technologies

Void Fraction Sensor for Packed-Bed Reactors in Microgravity

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Identification and Significance of Innovation

-- Packed-bed reactors are needed to reduce consumables for long-duration, crewed missions.
-- Development of packed-bed reactors for low-gravity requires knowledge of void fraction as well as flow regimes and pressure drop.
-- Flow regimes (fluid distribution) and pressure drop are different in low gravity (Motil *et al*., 2001, 2002).
-- Innovative instrumentation is needed to measure the void fraction in packed-beds with conductive liquids in low-gravity.

Technical Objectives

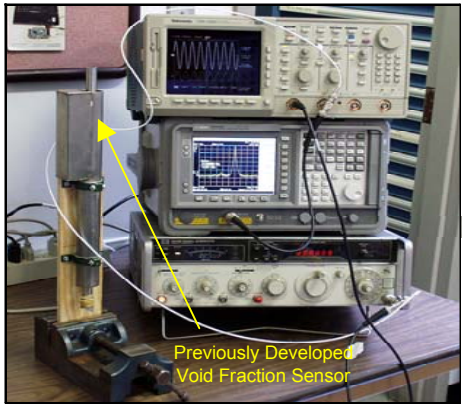
-- Develop new signal-conditioning electronics for use with conductive liquids
-- Adapt prior capacitance-based sensor approach for packed-bed geometry & flow regimes
-- Support ongoing OBPR-01-229 research to develop packed-bed reactors

Work Plan

-- Develop simple analysis to guide design
-- Perform quantitative multiphase flow tests
-- Design a prototype for Phase II research

Proof-of-Concept Demonstration

-- Bench-top signal-conditioning electronics
-- Existing Creare capacitance sensor
-- Packed-bed with glass beads in sensor
-- Static tests empty, liquid-filled, & drained



Preliminary Results

-- Presence of packed-bed particles alone alters measurement compared with no bed
-- Good sensitivity to distinguish between empty and liquid-filled
-- Good sensitivity to liquid holdup after draining
-- Complex response with frequency requires development of high-frequency (RF) signal-conditioning electronics

NASA Applications

-- Design & develop packed-bed reactors for Regenerative Life Support Systems (RLSS)
-- Design, develop & monitor cryogenic fluid transfer systems

Non-NASA Applications

-- Design & develop packed-bed reactors for chemical processing
-- Monitor cryogenic fluid processes

Contacts

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